Blockchain Technology Adoption in the State of Qatar: Qualitative Risk Analysis

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Abstract

Businesses may gain from implementing Blockchain-based technology in terms of profitability, productivity, and efficiency, which may cause them to re-evaluate their current business strategies. However, because the technology is still evolving and there needs to be more study on the effects of the various Blockchain networks (such as public, private, and consortium), their significance in developing new business models needs more consideration. In this article, we identified the potential risks/opportunities associated with Blockchain adoption in the state of Qatar through the standard technique of Qualitative Risk Analysis suggested by the Project Management Institution (PMI) using a standard (5 x 5) probability impact diagram (PID) with seven areas of impact namely Cost/Budget, Schedule, Quality, Customer Satisfaction, Business Continuity or Service Disruption, Governance & Compliance, and Environment. We found that circa 84% (i.e. 10 risks) of the most significant risks are related to the organisational and environmental risks, while only 16% (2 risks) are related to the technology itself. Our research highlights the benefits of Blockchain advancements to decision-makers for strategic planning.

Keywords: Blockchain Adoption; Blockchain barriers; Qualitative Risk Analysis

1 Introduction

Blockchain technology, which has recently emerged, has been praised as the next revolution that will change the structure and scope of organizations and the way economic transactions are carried out . However, beyond the primary technological focus of the majority of current work, adopting - Blockchain technologies necessitates taking a wide variety of issues into account(Janssen et al., 2020a).

Qatar is one of the countries that show intent on blockchain adoption. The Regulatory Communications Authority announced the “Qatar National Blockchain Blueprint” (QNBB) in April 2022. Moreover, the QNBB was created by the Communications Regulatory Authority (CRA) in collaboration with Hamad Bin Khalifa University and Qatar University (QU). It made its debut as a national consultation document that the CRA released. QU has gone above and beyond by announcing its venture into the Metaverse, a system firmly rooted in Blockchain technology(AIBC, 2022).

In Blockchain, Each transactionmay be confirmed by the entire network, which can be either public, private, or a consortium, and is based on advanced cryptography and mathematics(Schlecht et al., 2021a); it’s a distributed ledger in which all participants share ownership over transaction data rather

than just one(Schlecht et al., 2021a).

In the following sections, we will critically review four previous studies that addressed the problem of blockchain adoption and identify the potential risks/opportunities related to adoption in the State of Qatar.

2 Literature Review

Blockchain is an electronic distributed ledger that holds a list of constantly expanding data verified by every/or assigned network nodes. It includes a history of the network's transactions and a complete list of all of them. Because blockchain is decentralised, there is no longer a requirement for a third party, and all network nodes can see the records. As a result, building a transparent blockchain takes much more work than building centralised ledgers. To maintain security and privacy with these ledgers, you must work hard and include third parties. This idea was presented on a white paper that launched the first crypto currency, bitcoin, and focused on a decentralised cash flow mechanism (Nakamoto, 2008). Its remarkable characteristics of blockchain to have stimulated the creation of more than 1600 crypto currencies (Arooj et al., 2022).

Since then, this subject has instigated researchers to explore the potential of this technology. The recent available literature on the adoption of blockchain technology placed a strong emphasis on its technical aspects [5, 6], while organizational adoption requires a much more comprehensive perspective (Janssen et al., 2020b). Thus, they offered a theoretical paradigm for Blockchain technology adoption that would capture the intricate interactions between institutional, market, and technological issues. Hence, to determine the critical elements around blockchain technology, the writers first researched the literature on existing organisations and technology adoption. This analysis uncovered various factors that organizations needs to consider and expressed concerns about how to manage best to adopt this disruptive technology. These factors were divided based on the institutional framework proposed by (Koppenjan & Groenewegen, 2005) into the institutional, market, and technological aspects. However, the said article has a limitation related to the study period (2015-2018), where significant development in blockchain technology has taken place in last three years.

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The generalisation of much-published research on this topic needs to be revised. Hence, we set by this study, the building block for the decision makers/executives in the State of Qatar related to the adoption of this technology by answering the following questions:

Q1: What are the risks/opportunities associated with Blockchain adoption?

Q2: How can we prioritise those identified risks/opportunities?

Moreover, we proposed the agenda for future research studies.

3 Research Methodology

The Qualitative Risk Analysis (QRA) technique, as per PMI best practices in risk management, as adopted. Risk Management is an integral part of Enterprise Portfolio Management. The purpose of

Risk Management is to enable organisations to succeed in delivering business objectives by adopting a systematic approach to the identification, assessment and management of uncertain events, which may impact the business value.

The Qualitative Risk Analysis (QRA) technique allows risks to be ranked using a single-point estimate for Probability and Impact. This technique will enable the organisation's pre-determined scoring scheme and will also allow organizations in the early stages of strategic planning to rank and prioritise their risks/priorities.

3.1 Risk Identification

In this study, we have identified the risks related to blockchain adoption through a structured literature review of the reported risks/barriers and opportunities to blockchain adoption, where we concluded that the study carried out by (Kouhizadeh et al., 2021)had addressed the most published risks related to blockchain adoption in addition to other few risks identified on Table 1 below:

Table 1: Identified Risks/Opportunities Related to Blockchain Adoption as Cited from the Literature

Risk ID	Risk Type	Risk Title	Reference	Description	Risk Category
O01	Opportunity	high traceability	(Biswas & Gupta, 2019a; Munim et al., 2022)	The lack of traceability limits consumers' capacity to judge the quality of the products they buy and prevents them from tracking their purchases throughout the entire delivery process. Hence, customers' trust is positively proportional to the degree of traceability.	Technological
R01	Risk	Security challenge	(Biswas & Gupta, 2019a; Sayogo et al., 2015; W. Wang et al., 2019; Yli-Huumo et al., 2016)	There are worries that data and information may be vulnerable to security issues like hacking, the spread of false information, and access to sensitive data.	Technological
R02	Risk	Access to technology		For the adoption of blockchain, the internet and IT infrastructure are crucial resources. Sometimes an organization's IT infrastructure is inadequate or technological access is impractical.	Technological
R03	Risk	The negative perception oftechnology		People could primarily connect cryptocurrencies like Bitcoin and blockchain technology. These advances could be seen as malicious behavior. Organizations may therefore be reluctant to use blockchain technology in general.	Technological
R04	Risk	Immutability challenge of blockchain technology	(Biswas & Gupta, 2019b)	According to the idea of immutability, records cannot be removed from ledgers. However, the history of an incorrect record that was added to the blockchain will always be there if it can be updated with new information.	Technological
R05	Risk	Immaturity of technology	(Biswas & Gupta, 2019b)	One technological problem resulting from blockchain's infancy is the difficulty scaling the technology. Blockchain technology would struggle to handle a high volume of transactions. Additionally, storing blocks that are getting larger is a concern because it runs into massive real-world data (the "bloat" problem in Bitcoin).	Technological
R06	Risk	Garbage-in_Garbage-Out related	(Powell et al., 2022)	Blockchain applications in food supply chains do not solve conventional IoT data quality issues. Data on a blockchain may be immutable garbage.	Technological

Risk ID	Risk Type	Risk Title	Reference	Description	Risk Category
		to data integrity			
O02	Opportunity	Increase in information security	(Munim et al., 2022)	Proof of work and proof of stake are examples of blockchain consensus protocols which are widely used.	Technological
R07	Risk	Lack of Tools for Blockchain Technology Implementation	(Munim et al., 2022)	Due to the lack of hardware and software tools within an organization to use the technology along with the maintenance, it could be expensive to invest in the companies.	Technological
R08	Risk	Increase in prices	(Biswas & Gupta, 2019a)	Additional implementation costs, in addition to environmental costs and training costs	Orgnizational
R09	Risk	Lack of Expertise about Technology	(Munim et al., 2022)	lack of skills to use the technology and a thorough understanding of itis largely stopping the growth of an organization.	Organizational
R010	Risk	Financial constraints	(Biswas & Gupta, 2019a; A. Hughes et al., 2019; Sayogo et al., 2015)	Due to supply chain information collecting and system conversion; organizations incur costs. Adopting sustainable techniques can also be expensive. The financial resources available to organizations to use this technology are limited.	Organizational
R011	Risk	Lack of management commitment and support	(Mangla et al., 2017; Y. Wang et al., 2019)	Some managers do not utilize disruptive technology and supply chain management (SCM) procedures to support sustainable practices over the long term.	Organizational
R012	Risk	Lack of new organizational policies for using blockchain technology	(Mendling et al., 2018; Y. Wang et al., 2019)	A successful implementation of blockchain technology by organizations can be achieved if new policies have been established (for example, where and how to use the technology	Organizational
R013	Risk	Lack of knowledge and expertise	(Angelis & Ribeiro da Silva, 2019; Kamble et al., 2021a; Sayogo et al., 2015)	Lack of technical know-how and understanding of sustainable supply networks and blockchain technology.	Organizational
R014	Risk	Difficulty in changing organizational culture	(Mangla et al., 2017; Mendling et al., 2018)	The adoption of blockchain technology alters or affects the culture of the firm. Organizational culture includes norms for workplace behavior and an appropriate code of conduct.	Organizational
R015	Risk	Hesitation to convert to new systems	(Angelis & Ribeiro da Silva, 2019; Govindan et al., 2014; Schlecht et al., 2021b)	Legacy systems would need to be modified or replaced in order to adopt new systems. Organizations and companies may object and hesitate torespond to this change.	Organizational
R016	Risk	Lack of tools for	(Andoni et al., 2019;	Lack of standards, proper procedures, tools, and criteria for using blockchain technology and	Organizational

Risk ID	Risk Type	Risk Title	Reference	Description	Risk Category
		blockchain technology implementation in sustainable supply chains	Govindan et al., 2014; Mangla et al., 2017; Morkunas et al., 2019)	assessing organizational sustainability performance.	
R017	Risk	high energy consumption	(Biswas & Gupta, 2019b)	Blockchain consumes a considerable amount of energy, aggravating the problem of global warming. In fact, despite the fact that blockchain engineers are constantly looking for greener solutions, the status of the technology now makes blockchain unsustainable.	Environmental
R018	Risk	Lack of customers' awareness and tendency about sustainability and blockchain technology	(Chkanikova & Mont, 2015; L. Hughes et al., 2019; Mangla et al., 2017)	Lack of customer understanding of supply chain sustainability techniques using blockchain technology	Environmental context (Supply chain view)
R019	Risk	Problems in collaboration, communication and coordination in the supply chain	(Chen et al., 2022; Janssen et al., 2020b; Kamble et al., 2021b; Kshetri, 2018; Y. Wang et al., 2019)	Lack of cooperation, coordination, and communication among supply chain participants who have various and occasionally incompatible operational motives, aims, and priorities; additional barriers to cooperation	Environmental context (Supply chain view)
R020	Risk	Challenge of information disclosure policy between partners in the supply chain	(L. Hughes et al., 2019; Y. Wang et al., 2019)	Participants in a supply chain may have varied privacy requirements and rules regarding the information and data utilized in blockchain technology and sustainable supply networks. Data's economic worth, confidentiality, and privacy may need to be revised to avoid problematic issues.	Environmental context (Supply chain view)
R021	Risk	Challenges in integrating sustainable practices and blockchain technology through SCM	(Govindan et al., 2014; Luthra et al., 2016; Morkunas et al., 2019)	Combining traditional supply chain procedures with sustainability strategies and blockchain is complex. Additionally, the development of technology, materials, and processes is required to enable sustainable practices. In order to connect to the internet of things or collect data from it for blockchain technology and sustainability, for instance, facilities and machinery need to be updated.	Environmental context (Supply chain view)
R022	Risk	Cultural differences of supply chain partners	(Mengelkamp et al., 2018; Y. Wang et al., 2019)	Different organizational or geographic cultures of supply chain participants could obstruct the adoption of blockchain technology.	Environmental context (Supply chain view)
R023	Risk	Lack of governmental policies	(Biswas & Gupta, 2019b; Govindan	Governments might be reluctant to direct blockchain technology adoption and sustainable supply chain practices	Environmental Context (External view)

Risk ID	Risk Type	Risk Title	Reference	Description	Risk Category
			et al., 2014; L. Hughes et al., 2019; Mangla et al., 2017; Y. Wang et al., 2019)		
R024	Risk	Market competition and uncertainty	(Biswas & Gupta, 2019b; Mangla et al., 2017; Y. Wang et al., 2019)	It takes time to implement blockchain technology and sustainable practices. It may have an impact on the organization's ability to compete in the market and provide competitive risks. Examples of uncertainty include client behavior, market expectations for sustainable products, and upcoming sales.	Environmental Context (External view)
R025	Risk	Lack of external stakeholders' involvement	(Biswas & Gupta, 2019b; Y. Wang et al., 2019)	The failure of relevant NGOs and communities to embrace blockchain technology and sustainable practices, as well as their competing goals.	Environmental Context (External view)
R026	Risk	Lack of industry involvement in blockchain adoption and ethical and safe practices	(L. Hughes et al., 2019; Luthra et al., 2016)	Lack of industry leadership in sustainability, blockchain technology, and safe and ethical procedures.	Environmental Context (External view)
R027	Risk	Lack of rewards and incentives	(Luthra et al., 2016; Y. Wang et al., 2019)	Lack of reward mechanisms, a problem in promoting sustainable practices and blockchain technology, or a lack of incentives from authorities and professional bodies to encourage these policies.	Environmental Context (External view)

3.2 Risk Assessment

Standard (5 X 5) Probability Impact Diagram (PID) was used, and the impact was assessed against seven potential areas of impact, namely Cost / Budget, Schedule, Quality, Customer Satisfaction, Business Continuity or Service Disruption, Governance & Compliance, and Environment. Then we adopted the Delphi technique for scoring the identified risks by collecting responses from the subject matter experts in the industry (SMEs); we received 5 responses out of 10 sent invitations as per the list below in Table 2:

Table 2: List of Respondents (SMEs).

No	Organization	Role	Yrs of Experience
1	Public Works Authority	Information Systems Department (ISD) Manager	-
2	Public Works Authority	ISD - Enterprise Architect	20
3	KEO International Consultants. Qatar	Risk Manager	23
4	AECOM – Qatar	Risk Manager	23
5	Parsons International - Qatar	Risk Manager	16

4 Results and Discussion

Normality was assumed in the received responses. Hence, the combined risk register was calculated by considering the average of the received responses. Then the risk and opportunities heat map was created as shown on figures 1 and 2 below:

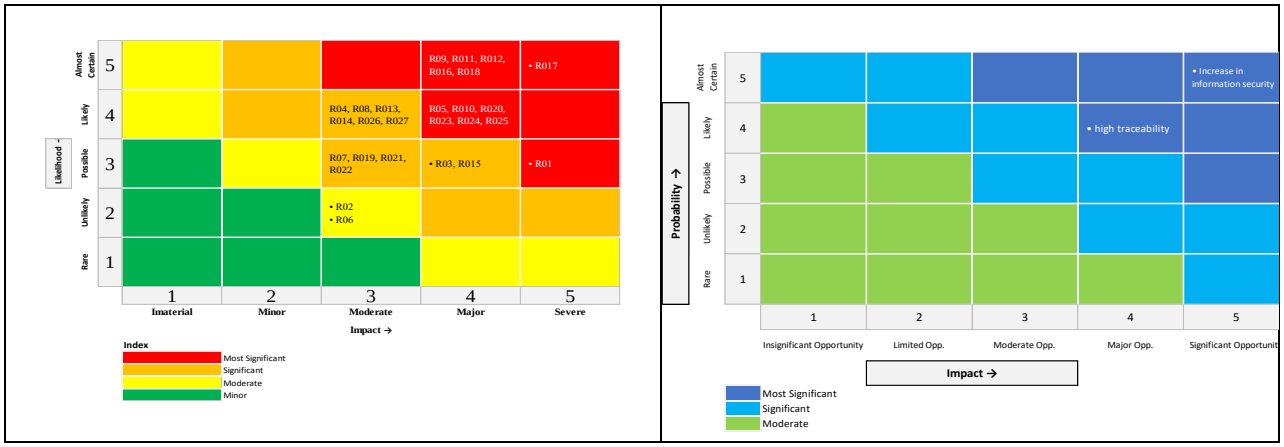

Fig.1: Combined Risks & Opportunities Heat Map

The first question in this study sought to determine the risks, while the second one was to determine the priority of those risks; by reviewing the heat maps mentioned above for risks and opportunities, it is evident that the following risks are the most significant risks related to blockchain adoption:

We found that circa 84% (i.e., 10 risks) of the most significant risks are related to organisational and environmental risks, while only 16% (2 risks) are related to the technology itself. Even the security challenges (Risk ID R01) were suggested by the IT SMEs (i.e. ISD Manager and ISD-Corporate Architect) to consider it as an opportunity with the following note:

"*Blockchain is built on security by design. This can be re-written as an opportunity*" *..ISD-Manager*

5 Conclusion and Future Work

Blockchain is a distributed electronic ledger in which every transaction is recorded publicly and is accessible to all users of the network or nodes. After Satoshi, originally, introduced the idea of a blockchain in 2008, scientists worldwide began to take notice. This new field of study has opened up new avenues for examination, leading to new research fields and resolving of problems in the current blockchain network.

The main purpose of this study was to identify the risks and opportunities associated with the adoption of blockchain in the State of Qatar and prioritize them. Both questions where answered through carrying out a systematic qualitative risk analysis using standard practices of risk management issued by Projects Management Institute (PMI) and the Delphi technique used in data collection from the industry SME. Although the current study is based on a small sample of participants, our findings suggests that the organisational and environmental risks are the most significant risks influencing the effective adoption of this technology in the state of Qatar. These findings will help managers and decision-makers in Qatar through the strategic planning for the adoption of Blockchain. Moreover, it adds to the body of knowledge by distinguishing the local differences associated with this part of the world.

However, this study has limitations related to the size of the sample and the diversity of the sample. Hence, it is recommended to run the study in a more diversified population to include SMEs from different sectors, mainly, Financial sector, Health care, and supply chain sector.

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